

DATE: lec 4

SUBJECT: _____

Fundamentals of industrial instrumentation AND process control

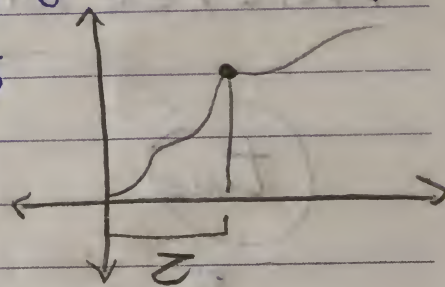
هنا عندنا نظام ميكانيكي ولكننا معادلات النظام آتية من جزء $\frac{dx}{dt} = x = ax + bu + b_2 u(t-2)$ أين

$$\frac{dx}{dt} = x = ax + bu + b_2 u(t-2)$$

$$sX(s) - X_0 = aX(s) + b_1 u(s) + b_2 u(s)e^{-2s} \quad (1)$$

$$(s-a)X(s) = X_0 + b_1 u(s) + b_2 u(s)e^{-2s}$$

$$X(s) = \frac{X_0}{s-a} + \frac{b_1 u(s)}{s-a} + \frac{b_2 u(s)e^{-2s}}{s-a}$$



عجز Laplace في حلها

لا يساوي حل نقل z $\frac{dz}{ds} = -2$

$$s e^{2s} X(s) - e^{2s} X_0 = a e^{2s} + b_1 e^{2s} u(s) + b_2 u(s) e^{-2s} e^{2s}$$

$$\frac{d}{dz} e^{2s} X(s) =$$

$$\frac{d}{dz} P(z,s) = P(z,s) + e^{2s} X_0 + b_1 e^{2s} u(s) + b_2 u(s)$$

$$F(z,s) = F(s,z) +$$

$$\Theta F(\Theta,s) - X(s) = F(\Theta,s) + \frac{X(0)}{\Theta-s} + \frac{b_1 u(s)}{\Theta-s} + b_2 u(s)$$

$$(\Theta-1)F(\Theta,s) = X(s) + \frac{X(0)}{\Theta-s} + \frac{b_1 u(s)}{\Theta-s} + b_2 u(s)$$

(((ALQSA)))

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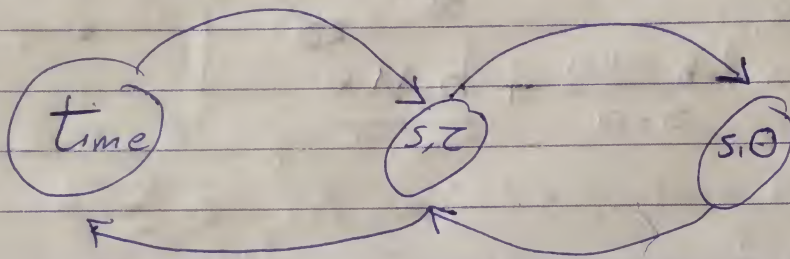
$$F(\theta, s) = \frac{X(s)}{\theta - 1} + \frac{X_0}{(\theta - s)(\theta - 1)} + \frac{b_1 U(s)}{(\theta - s)(\theta - 1)} + \frac{b_2 U(s)}{(\theta - 1)}$$

inverse Laplace

$$F(z, s) = e^{zs} X(s) + (e^{zs} + e^z) X_0 + (e^{zs} + e^z) U(s) + b_2 e^z U(s)$$

$t \leftarrow s \text{ mod } 2\pi i$ Inverse Laplace

$$F(z, t) = e^z X(t) + X_0 (K e^z U_s(t+z))$$



Digital Control \Rightarrow multi decision

analogue \Rightarrow single decision

Data acquisition \Rightarrow سensors

manipulated variables \Rightarrow المتغيرات التي سوف يتم تعديلها

Set point \Rightarrow desireal point المطلوب

actual o/p desire o/p مع

Controller \Rightarrow Transient period only \Rightarrow Control

(((ALARA)))

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* transient IP on 12-19 suddenly change Cuzid*